

### Analog Position Sensor System

Mechanical, analog system comprising sensor and processor for accurately recording the position of gripper jaws.



#### Function description

The high-resolution APS-M1S sensor is actuated by an inclined surface (mounting kit), which is attached to the gripper base jaw. The changes in position of the sensor are recorded, amplified, prepared and made available to an analog output by the APS-M1E processor.

#### Your advantages and benefits

##### Position output

as voltage (V) or current (mA)

##### Precise measuring system

also for long strokes

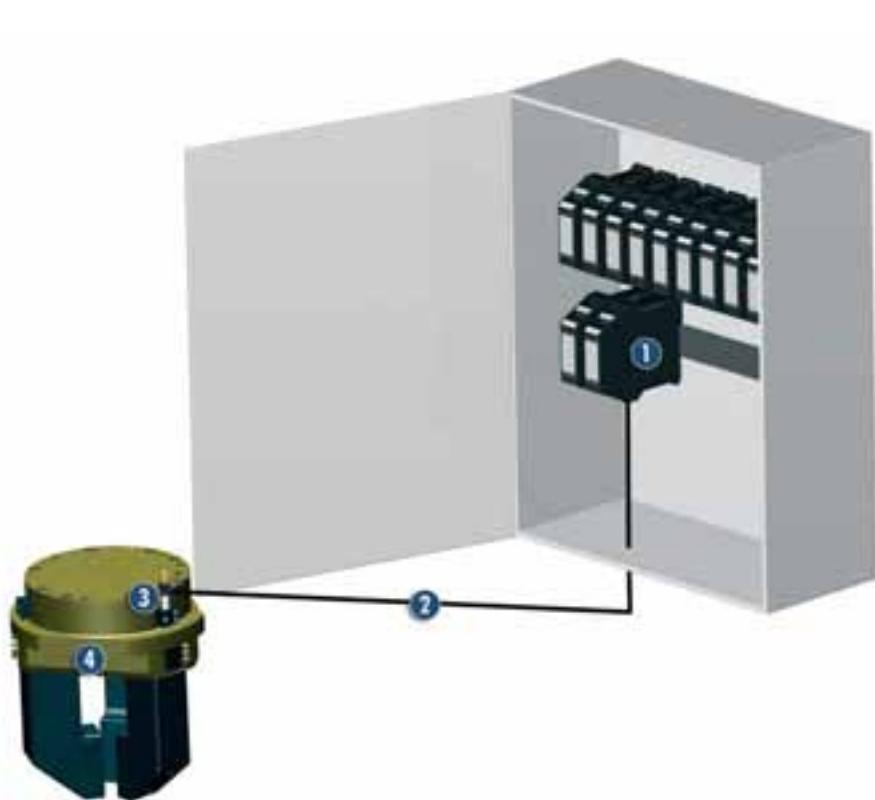
##### Compact design

for space-saving installation in any control cabinet

##### Conforms to CE

for absolute safety and long life during permanent operation

## Application example



### Area of application

for the precise measurement of the gripper jaw position in clean environments

- 1 APS-M1 Processor
- 2 APS-K7 Extension Cable

- 3 APS-M1S Sensor
- 4 PZN-plus 100  
3-Finger Centric Gripper

## General information

### Warranty

24 months

### Ordering

The sensor and processor must be ordered as individual items.

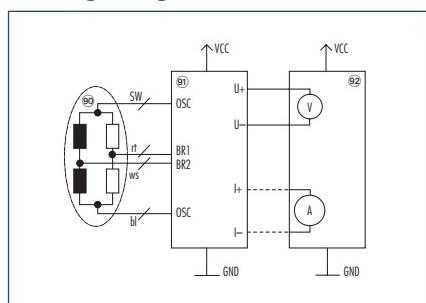
### Notes

The accuracy of the complete system as stated here is available from a stroke per jaw of 7 mm. The entire range of the sensor cannot be exploited with smaller strokes. The relative accuracy (ratio of repeat accuracy to jaw stroke) decreases, the absolute repeat accuracy (in mm) is the same as for a gripper with a 7 mm stroke, i.e. 0.021 mm.





### Wiring diagram



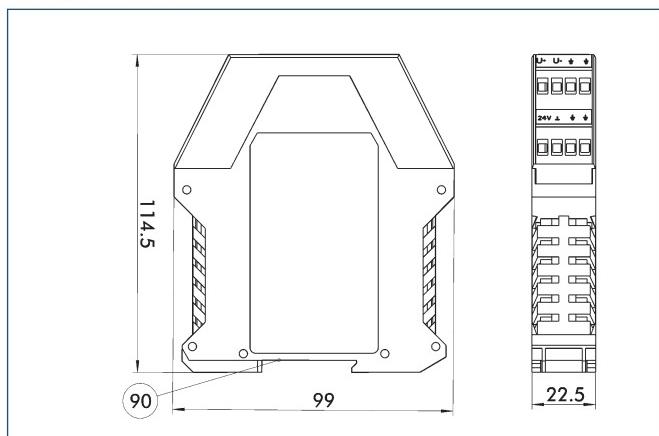
- ⑨0 APS-M1S Sensor
- ⑨1 APS-M1E Electronic Processor
- ⑨2 Automation device, e.g. S7-300

ⓘ When using an APS system, a mounting kit, APS sensor (APS-M1S) and processor (APS-M1E) are required for each gripper. The mounting kits can be found with the grippers. Mounting kits for other components/grippers are available on request. The sensor has a 3 m molded cable.

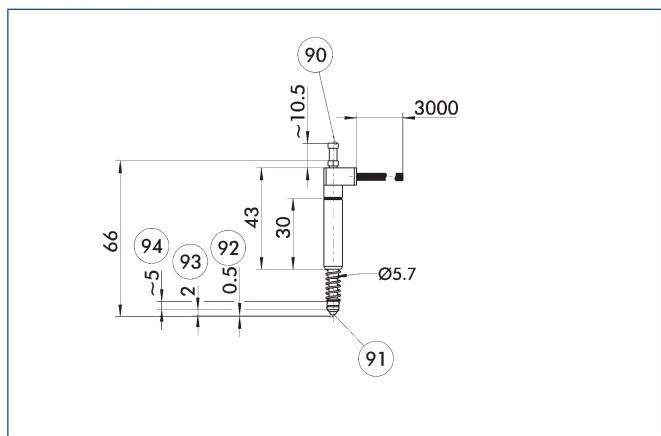
### Technical data

Description	APS-M1S
ID	0302062
Measuring stroke	[mm]
2.0	
Measuring accuracy	[mm]
0.004	
Nominal current input	[A]
0.023	
Tightness	67
Thermal drift of zero signal	[%/10K]
0.1	
Thermal drift of amplification factor	[%/10K]
0.2	
Min. ambient temperature	[°C]
10.0	
Max. ambient temperature	[°C]
60.0	
Weight	[kg]
0.16	
Sensor material	Steel
Cable sheath	PUR

Description	APS-M1E
ID	0302064
Supply voltage	DC
Nominal voltage	[V]
24.0	
Min. voltage	[V]
22.0	
Max. voltage	[V]
26.0	
Nominal current	[A]
0.1	
IP rating	20
Min. ambient temperature	[°C]
0.0	
Max. ambient temperature	[°C]
60.0	
Repeat accuracy (sensor and processor)	[mm]
0.3	
Weight	[kg]
0.16	
Housing material	PA
Output signal	0..10 V DC   4..20 mA
Mounting	top hat rail

**APS processor**

⑨⓪ Groove for mounting rail

**APS sensor**

⑨⓪ Position with retracted feeler rod

⑨1 Carbide ball 1/8"

⑨2 Initial stroke

⑨3 Range of measurement

⑨4 Free stroke

**APS-K extension cable**

As an option, an extension cable can be connected between the sensor and the processor. (The max. cable length between the sensor and the processor is 10 m, between the processor and its controller (SPC) max. 1 m.)

Description	ID	Length
APS-K2	0302066	2.0 m
APS-K7	0302068	7.0 m

**Mounting kits**

The suitable mounting kit is specified with the gripper.

ID	Description
0302075	AS-APS-M1-64/1
0302076	AS-APS-M1-64/2
0302077	AS-APS-M1-80/1
0302078	AS-APS-M1-80/2
0302079	AS-APS-M1-100/1
0302080	AS-APS-M1-100/2
0302081	AS-APS-M1-125/1
0302082	AS-APS-M1-125/2
0302083	AS-APS-M1-160/1 and 240/2
0302084	AS-APS-M1-160/2
0302085	AS-APS-M1-200/1 and 380/2
0302086	AS-APS-M1-200/2
0302087	AS-APS-M1-240/1
0302088	AS-APS-M1-300/1
0302089	AS-APS-M1-300/2
0302090	AS-APS-M1-380/1



## FPS Flexible Position Sensor

The optional FPS sensor system measures the position of gripper jaws. It then indicates in which of the five freely teachable zones the jaws currently are. Alternatively, the jaw position can be read out via the "FPS Controller" software (FPS-F5/ F5T only).



### Function description

A permanent magnet that moves with the base jaw provides the FPS sensor with its magnetic field. The strength of this permeation changes depends on the distance of the magnet from the sensor. This variable is recorded, evaluated and output by the FPS electronic processor.

### Your advantages and benefits

#### Simplest operation

with just two buttons, or with the machine control system using free control lines

#### Simple start-up

as the customer can set all positions during the teaching operation

#### Five digital outputs

for greater economy as compared to individual sensors

#### Small distance between two switching points, adjustable

#### Resistant to contamination

through non-ferromagnetic materials

#### Function and switching status display

via LEDs on the electronic processor

#### Conforms to CE

for safety and long life during permanent operation

#### Digital technology

for resistance to interference

#### Additional advantages of the FPS-F5 and F5 T

- Measuring functionality
- Communication and remote maintenance via RS-232 protocol
- Position programming and readout of switching points
- Monitoring of temperature and input voltage
- Visualization via PC possible
- Data logging
- Calibration of system to gripper stroke
- Intelligent access authorization
- Adaptation to new product during the process

## Application example



## Area of application

Position sensing of gripper jaws up to a stroke of approx. 30 mm in environments that may be clean or dirty, but are free from steel chips.

## General information

### Resolution

The resolution is the minimum stroke difference that is required in order to reliably distinguish between two signals. Used in conjunction with most SCHUNK grippers, the FPS system achieves a resolution of 1 – 3 % of a jaw stroke. However, in some grippers a resolution of only 10 % is achieved due to the nature of the design. More precise resolutions may be reached, however, with the use of special solutions. Please contact us regarding the resolution/accuracy of the FPS system.

### Connector for the electronic processor (enclosed)

12-pin circular connector (Binder type series 723, waterproof) suitable for connection cables with a diameter of 6 to 8 mm, recommended conductor cross-section 0.14 mm<sup>2</sup> (max. 0.25 mm<sup>2</sup>)

### Ambient conditions

Use within the range of strong magnetic fields is not recommended. Neither the FPS sensor nor the FPS magnet may come into contact with ferromagnetic dust, chips or other substances.

### Display

Five colored LEDs

### Range of measurement

5 to 30 mm with SCHUNK magnet (NdFeB magnet cut to size, dimensions (6 x 25 mm x L) with various lengths L depending on the part of the range of measurement

### Material

Processor: Plastic PA 6

Cable: PU, resistant to coolants/lubricants

### Warranty

24 months

## Notes

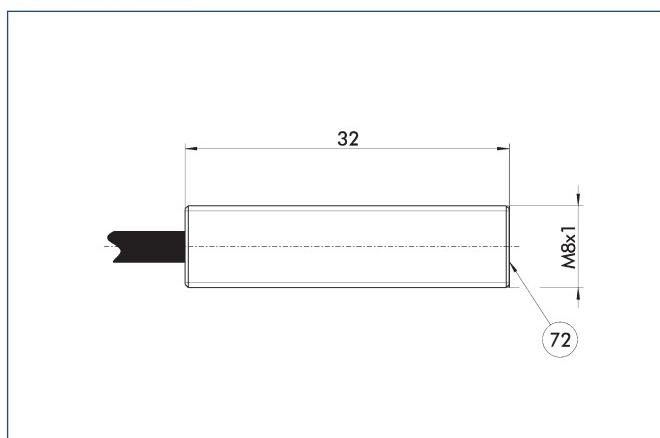
All data were determined on the basis of SCHUNK attachments and specifications. Please consult us regarding use of the sensor with modules from other manufacturers.



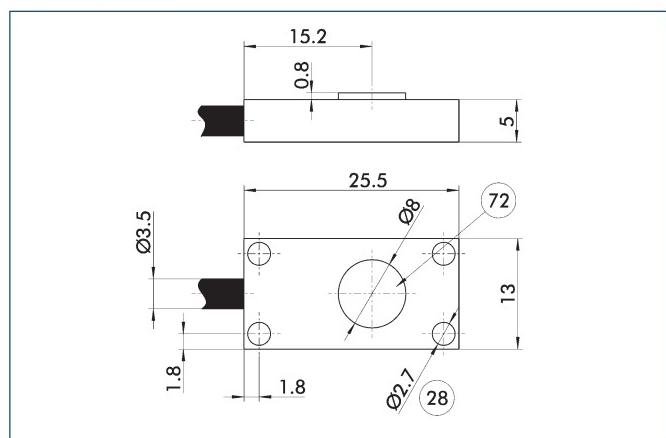
**FPS sensors**

Either the FPS-S13 or the FPS-SM8 sensor is required, depending on the type of gripper. Each sensor is connected to its own FPS-A5/F5/F5T processor.

Description	FPS-S 13	FPS-S M8
ID	0301705	0301704
Cable diameter [mm]	3.5	3.5
Cable length [cm]	30.0	30.0
Connection of FPS on processor side	M8	M8
Weight [kg]	0,01	0,015
Min. ambient temperature [°C]	-25.0	-25.0
Max. ambient temperature [°C]	70.0	70.0
IP rating (sensor)	65	65
IP rating (connector, plugged in)	65	65
Min. bending radius (dynamic) [mm]	17.5	17.5
Min. bending radius (static) [mm]	35.0	35.0

**S-M8 sensor**

(72) Active sensor surface

**S13 sensor**

(28) Through-bore

(72) Active sensor surface

**Cable extensions**

Max. extension between FPS sensor and electronic processor for trouble-free operation: 1 m

Description	ID	Length
KV 05	0301598	0.5 m
KV 1	0301599	1.0 m



### FPS-A5/FPS-F5 Processor



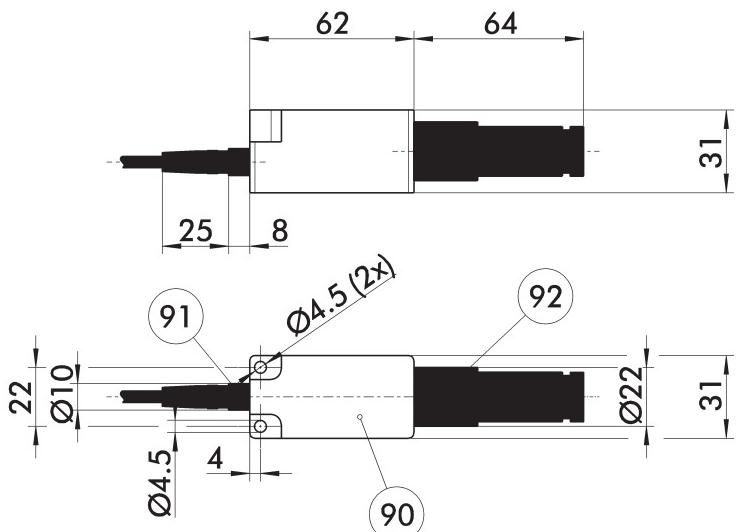
Measurement of the gripper stroke using sensors, assignment to the positions/zones "Open", "Intermediate position 1,2,3" or "Closed", and output of a position signal. A maximum of four switching points/five zones are freely programmable. FPS-F5 additionally with RS-232 interface, remote maintenance, measuring functionality, system calibration to the millimeter, temperature and voltage monitoring.

### FPS-F5T processor

Measurement of the gripper stroke using sensors, comparison with target value, output of tolerance information "Within tolerance", "Above tolerance" or "Below tolerance", plus "Open" and "Closed". Otherwise, like the FPS-F5.

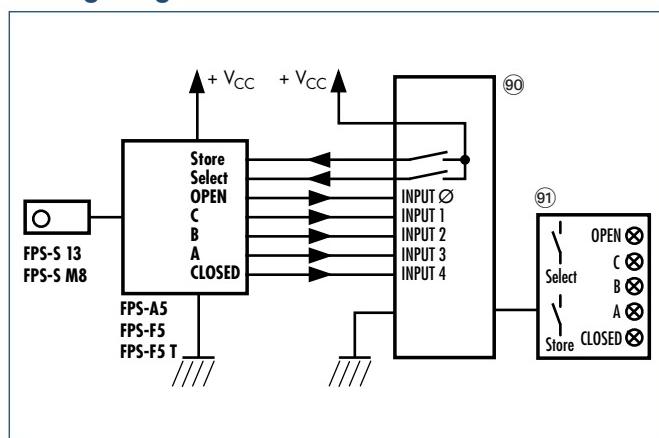
Description		FPS-A5	FPS-F5	FPS-F5 T
	ID	0301802	0301805	0301807
Nominal voltage	[V]	24.0	24.0	24.0
Min. voltage (DC)	[V]	10.0	10.0	10.0
Max. voltage (DC)	[V]	30.0	30.0	30.0
Nominal current (DC)	[A]	0.01	0.01	0.01
Weight	[kg]	0.06	0.06	0.06
Min. ambient temperature	[°C]	-25.0	-25.0	-25.0
Max. ambient temperature	[°C]	70.0	70.0	70.0
IP rating		65	65	65

## Main views



- ⑨⓪ Transparent plastic cover, over control and display panel
- ⑨① Connector on sensor side
- ⑨② Connector on control cabinet side

## Wiring diagram



⑨⓪ SPC/PLC

⑨① Machine panel (provided by customer)

For the contact assignment of the connections on the PLC side, please refer to the user's manual.

## Cable extension (open wires)

From the electronic processor to the control cabinet

Description	ID	Length
KV 10	0301801	10.0 m



### Software for FPS-F5/F5 T

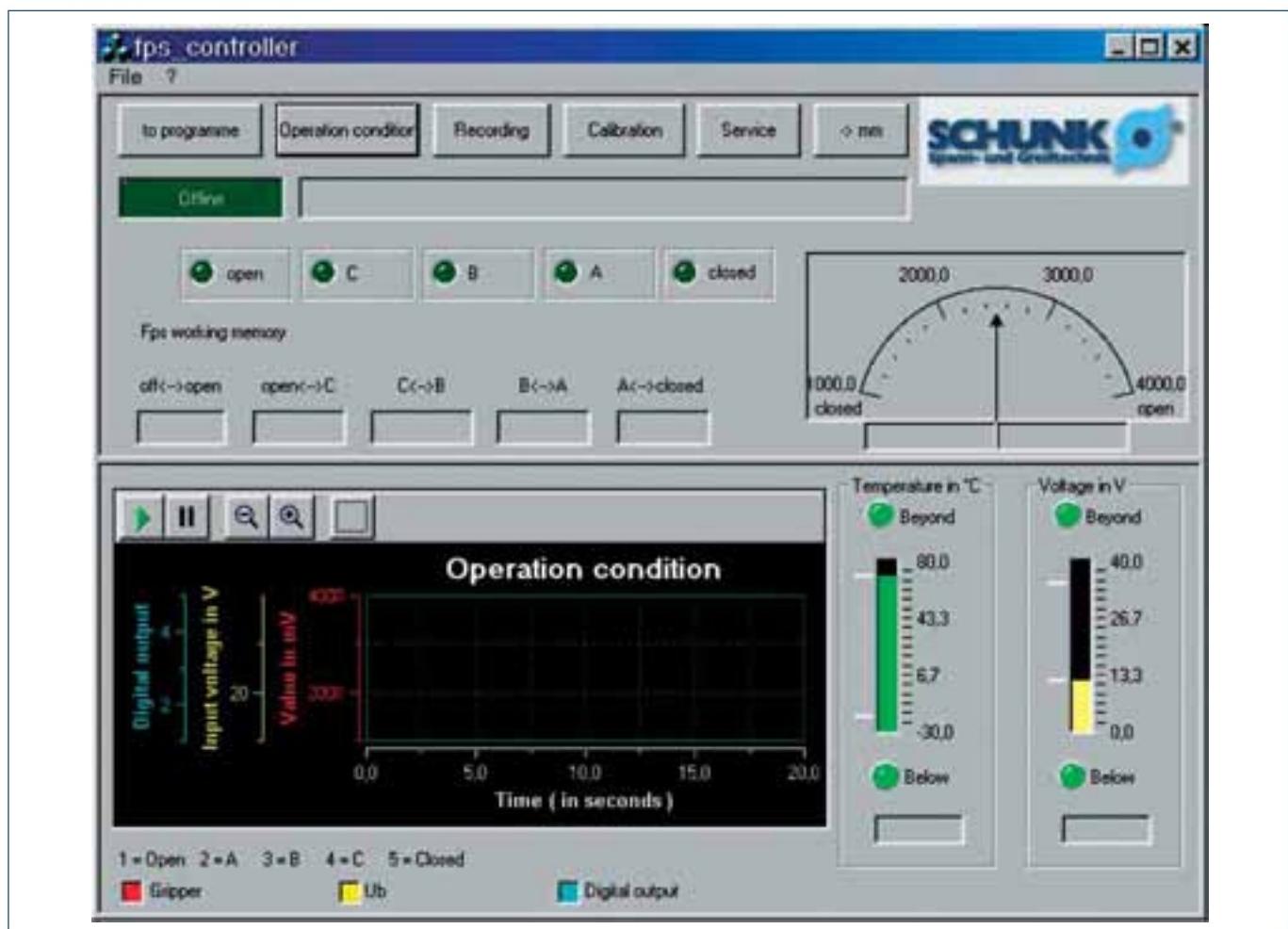


The free FPS Controller software allows the user to monitor the FPS processor via an RS-232 interface. As a result, the FPS system can be calibrated to stroke measurement, the position can be read out and the FPS processor can be programmed. The FPS software also provides access to all auxiliary functions (see above).

Description
ID (CD)
Download
Operating system

Software
0301806
<a href="http://www.schunk.com">www.schunk.com</a>
MS Windows

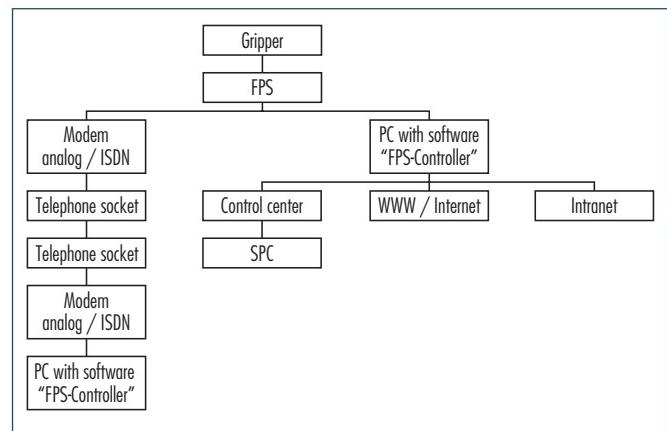
## Screenshot software



## Set-up with laptop



## Possible connection methods



## Force Measuring System

The FMS force measuring system is used for measuring the gripping forces during the gripping process. This opens up numerous new possibilities both during start-up and in the production process.



### Function description

The FMS intermediate jaws are screwed on between the gripper base jaw and the top jaw, which comes in contact with the workpiece. Gripping forces on the top jaw result in a flow of force through the FMS intermediate jaw. Intelligently arranged strain gauges inside the intermediate jaw react to the resulting deformation. The FMS processor detects the change in the strain gauges and emits an analog signal indicating the force.

### Your advantages and benefits

#### Simplest handling

via a control line that is directly connected to an SPC

#### Easy-to-perform measurement

of the actual, active gripping force

#### Result output via analog voltage value

#### Simple, linear relationship

between output voltage and gripping force

#### Simple zero balancing

with button or via control line

#### Integrated LCD

for visual monitoring

#### Easy assembly

#### Dirt-proof and waterproof

also for use in extreme ambient conditions.

## Application example



- 1 PGN-plus 100 AS  
2-Finger Parallel Gripper**
- 2 FMS-ZBA Intermediate Jaw  
with Sensor (active)**
- 3 FMS-ZBP Intermediate Jaw  
without Sensor (passive)**

- 4 Workpiece-specific Gripper Finger**
- 5 Electronic Processor**

### Area of application

#### Gripping force control

By sending control signals to the proportional valve that supplies the gripper, the PLC can influence the automatically measured gripping force.

#### Teaching robots

When gripping firmly fixed workpieces, the teaching of robots is simple and precise. Symmetrical gripping only takes place if the left- and right-hand gripper jaws apply the same force – thereby protecting the gripper and the robot.

#### Static grip force monitoring

- Monitoring the grip force as the jaws close prevents the workpiece from being dropped when movement initiates.
- Overload protection by monitoring the max. permitted force, which can be triggered e.g. by an inadvertent increase in pressure, by off-center gripping or the incorrect positioning of the workpiece.
- Preventive maintenance by replacing grippers in good time when there is a decline in the gripping force. This avoids unexpected manufacturing down-times.

#### Dynamic grip force monitoring

- The effect of acceleration forces on the gripper jaws can be recorded and the motion sequence modified if necessary.
- Component monitoring during highly dynamic movements.

#### Measuring and teaching processes

- Dimensional checking of the gripped component on the basis of an inserted reference component. If the component to be measured differs by more than  $\pm 0.05$  mm from the reference component, teaching can take place. If the difference is smaller, the precise dimensions can be measured accurately even to within  $\pm 0.002$  mm.
- Gauging the weight of the component by measuring the force due to weight of the component on the gripper fingers.

### Notes

The FMS force measuring system allows you to measure forces that act on the base jaw in the direction of the jaw movement. Up to three active (equipped with sensors) FMS-ZBA intermediate jaws are required for this purpose, depending on the application. The remaining base jaws are equipped with FMS-ZBP passive intermediate jaws (without sensors). Each FMS-ZBA active intermediate jaw requires an FMS-A1 electronic processor for evaluation, and an FMS-AK connection cable for connecting the electronic processor to an PLC or a control cabinet.

## General information

### For all PGN-plus and PZN-plus grippers

as well as for all grippers with identical finger connection diagram, for other grippers on request (remember to ask about the delivery time!)

### Conforms to CE

for absolute safety and long life during permanent operation

### Warranty

24 months



### FMS Processor



Each FMS-ZBA active intermediate jaw requires an electronic processor.

The FMS-A1 processor is required for intermediate jaw sizes up to 125, the FMS-A2 processor from size 160. The electronic processor is used to prepare, display and forward the measurement results. It is equipped with a housing connector and socket for connecting the force measuring jaw and the connection cable.

Description		FMS-A1	FMS-A2
	ID	0301810	0301811
Measuring accuracy	[%]	3.0	3.0
Output signal		-5VDC.. +5VDC	-5VDC.. +5VDC
Type of voltage		DC	DC
Nominal voltage	[V]	24.0	24.0
Min. voltage	[V]	18.0	18.0
Max. voltage	[V]	30.0	30.0
Nominal current	[A]	0.0045	0.0045
IP rating		67	67
Weight	[kg]	63.0	63.0

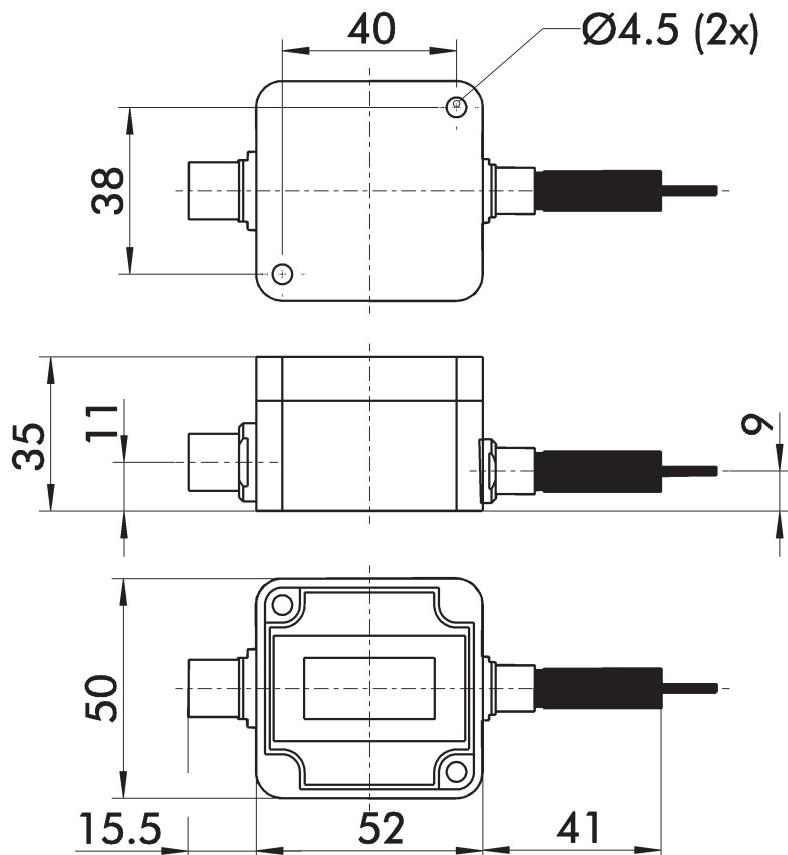
① The output voltage is linear to the forces occurring at the gripper fingers.

The bandwidth of the output signal is not fully exploited by every active intermediate jaw.

Zero balancing must be performed prior to measurement.

The limit class A according to EN 61326 is complied with.

The test to EN 61000-4-2, EN 61000-4-3, EN 61000-4-4 and EN 61000-4-6 was passed in conformity with EN 61326.

**Main views****FMS-AK connection cable**

The FMS-AK connection cable is used for connecting the electronic processor to a control cabinet or an PLC. A cable bushing is fitted on the side of the electronic processor, the other side is open.

Description	ID	Length
FMS-AK 5	0301821	5.0 m
FMS-AK 10	0301822	10.0 m
FMS-AK 20	0301823	20.0 m



### Force measuring jaws



The force measuring jaw is situated between the gripper base jaw and the top jaw. The gripping force is conducted through it. Active intermediate jaws measure these forces and transfer the measured value to the electronic processor. Active intermediate jaws are equipped with a 30 cm cable and a cable connector. Passive intermediate jaws act solely as a bridge for the forces.

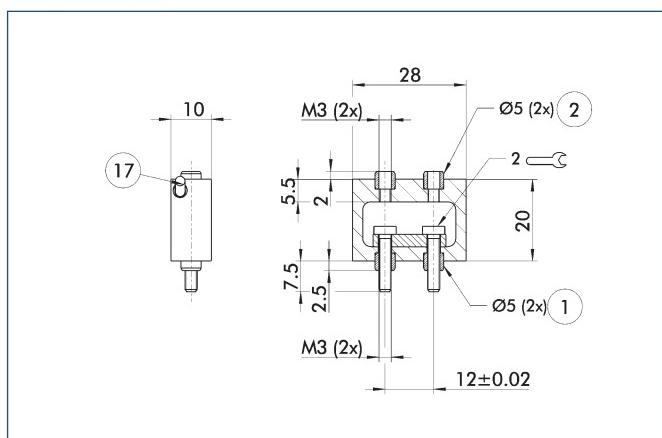
### Definitions

ⓘ The range of measurement is the range in which the overall system has an accuracy of < 3 %.

The overload range is the range in which the overall system has an accuracy of > 3 %. At the end of the overload range there is a risk of mechanical destruction of the intermediate jaw.

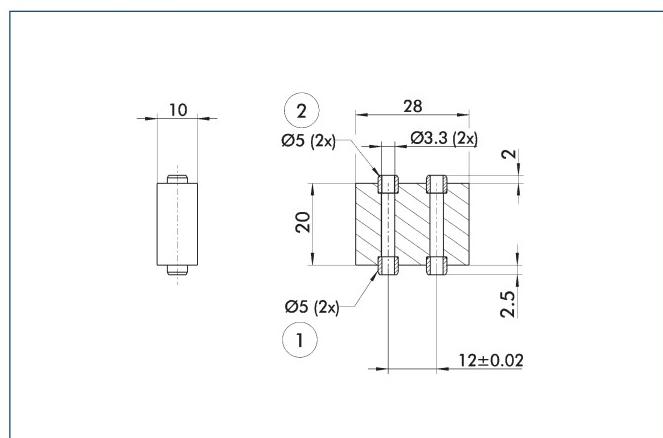
Description	ID	Start of range of measurement [N]	End of range of measurement [N]	End of overload range [N]	Weight [kg]	Min. ambient temperature [°C]	Max. ambient temperature [°C]
FMS-ZBA 50	0301830	0.0	145.0	290.0	0.03	-10.0	70.0
FMS-ZBP 50	0301831				0.02		
FMS-ZBA 64	0301832	0.0	260.0	520.0	0.04	-10.0	70.0
FMS-ZBP 64	0301833				0.025		
FMS-ZBA 80	0301834	0.0	430.0	860.0	0.056	-10.0	70.0
FMS-ZBP 80	0301835				0.035		
FMS-ZBA 100	0301836	0.0	685.0	1370.0	0.082	-10.0	70.0
FMS-ZBP 100	0301837				0.055		
FMS-ZBA 125	0301838	0.0	1120.0	2240.0	0.128	-10.0	70.0
FMS-ZBP 125	0301839				0.105		
FMS-ZBA 160	0301840	0.0	1600.0	3200.0	0.24	-10.0	70.0
FMS-ZBP 160	0301841				0.185		
FMS-ZBA 200	0301842	0.0	2325.0	4650.0	0.403	-10.0	70.0
FMS-ZBP 200	0301843				0.34		
FMS-ZBA 240	0301844	0.0	3700.0	7400.0	0.69	-10.0	70.0
FMS-ZBP 240	0301845				0.59		
FMS-ZBA 300	0301846	0.0	5150.0	10300.0	0.907	-10.0	70.0
FMS-ZBP 300	0301847				0.78		
FMS-ZBA 380	0301848	0.0	7100.0	14200.0	1.84	-10.0	70.0
FMS-ZBP 380	0301849				1.6		

### FMS-ZBA 50



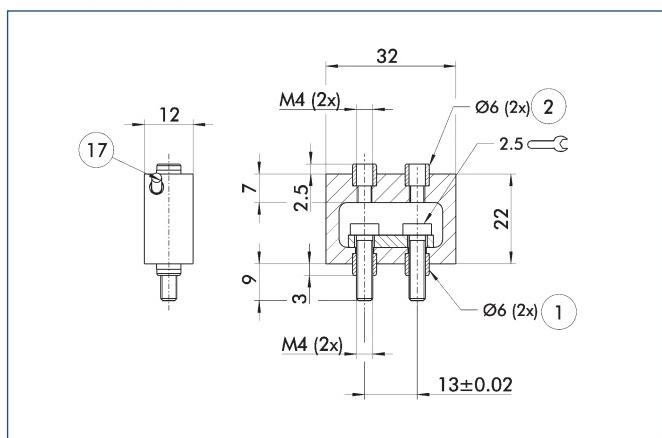
- ① Gripper connection
- ② Finger connection
- ⑯ Cable outlet

### FMS-ZBP 50



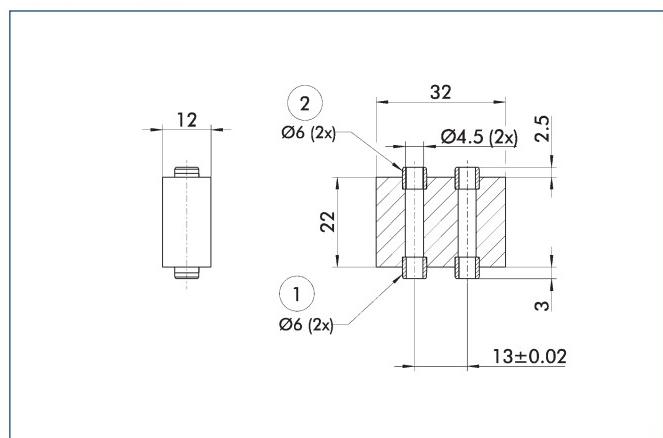
- ① Gripper connection
- ② Finger connection

### FMS-ZBA 64



- ① Gripper connection
- ② Finger connection
- ⑯ Cable outlet

### FMS-ZBP 64



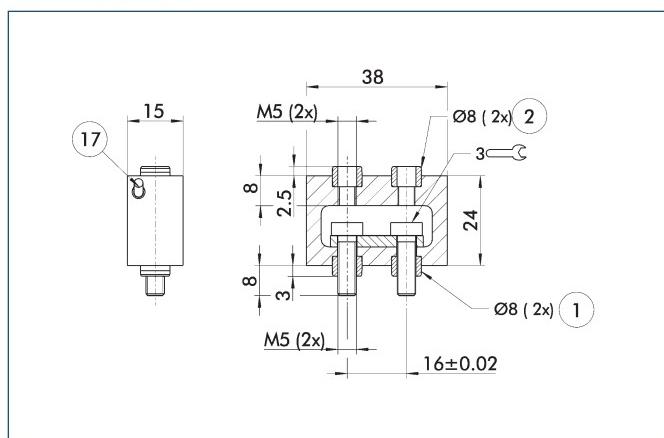
- ① Gripper connection
- ② Finger connection



# FMS-ZBA/-ZBP

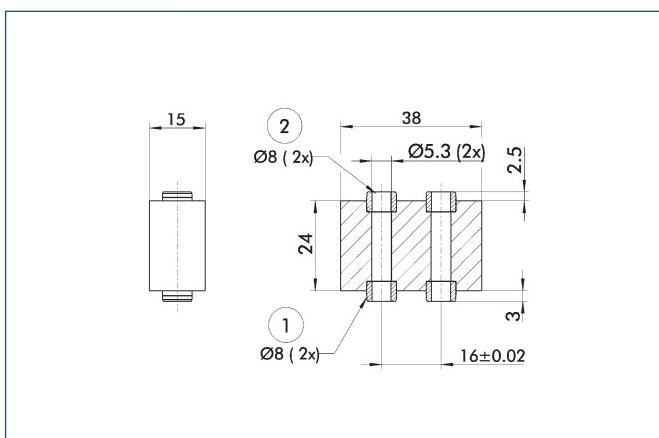
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## FMS-ZBA 80



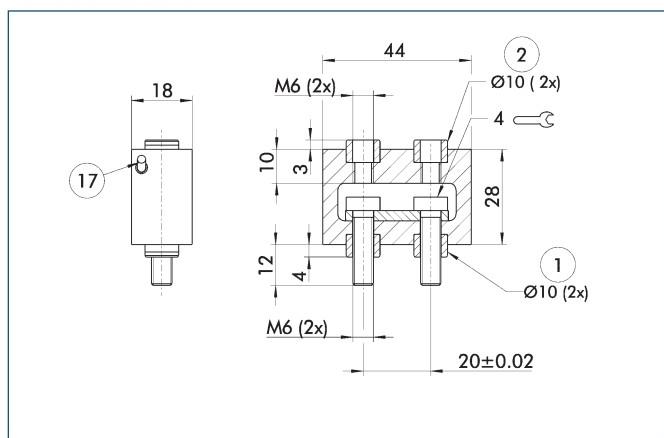
- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

## FMS-ZBP 80



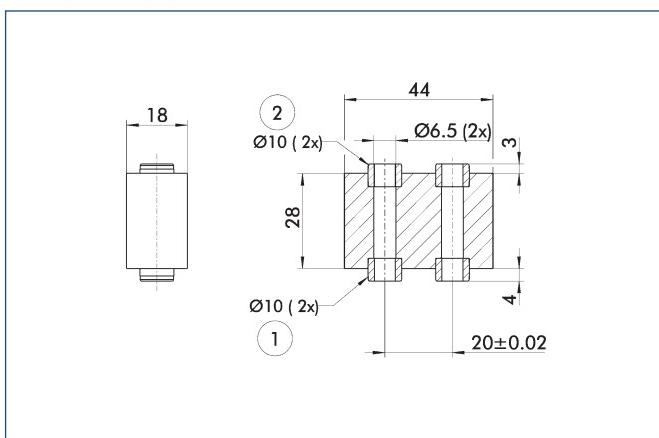
- (1) Gripper connection
- (2) Finger connection

## FMS-ZBA 100

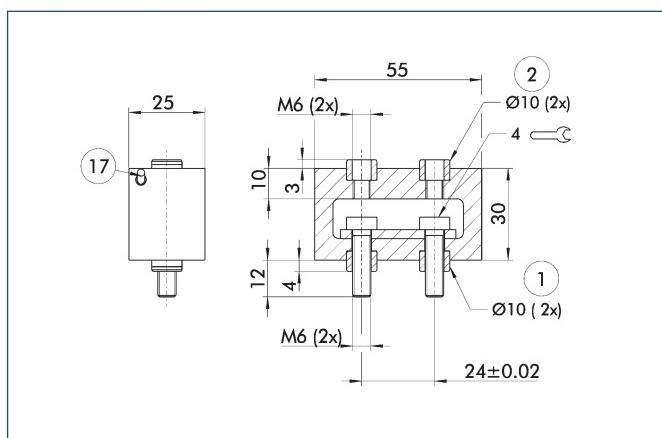


- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

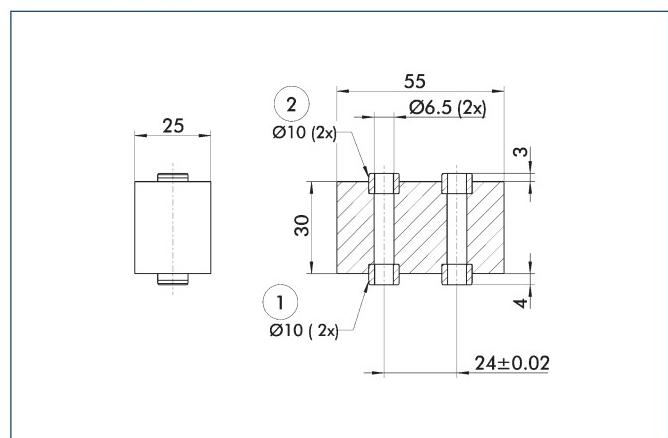
## FMS-ZBP 100



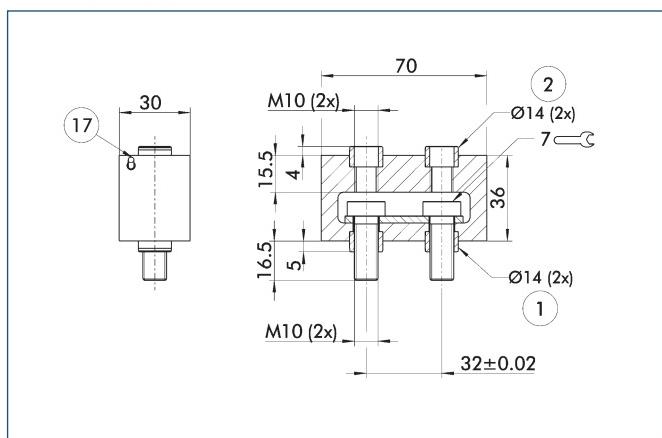
- (1) Gripper connection
- (2) Finger connection

**FMS-ZBA 125**

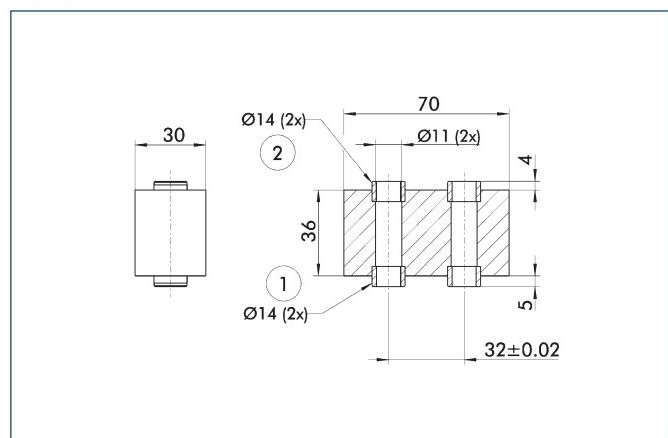
- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

**FMS-ZBP 125**

- (1) Gripper connection
- (2) Finger connection

**FMS-ZBA 160**

- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

**FMS-ZBP 160**

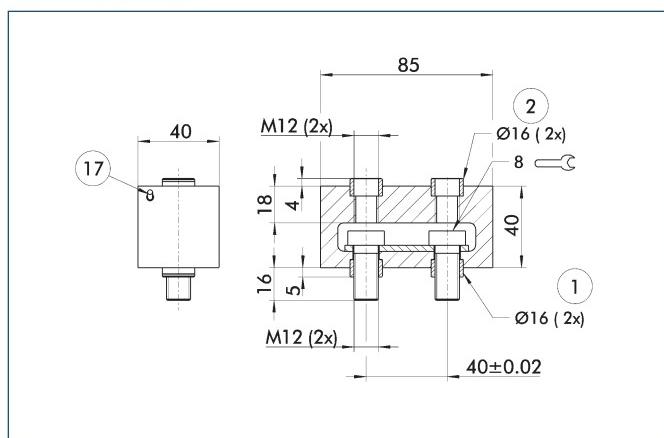
- (1) Gripper connection
- (2) Finger connection



# FMS-ZBA/-ZBP

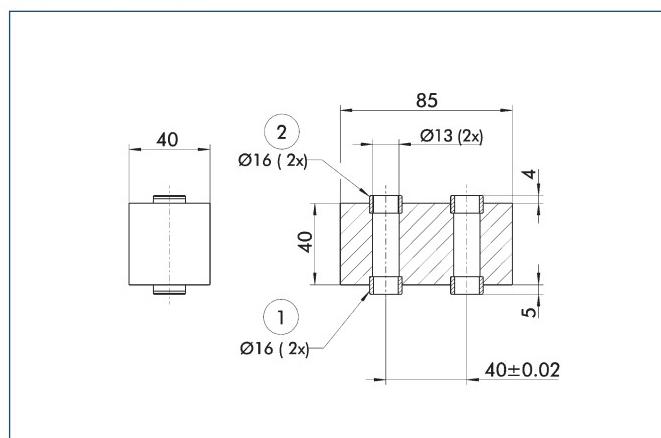
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## FMS-ZBA 200



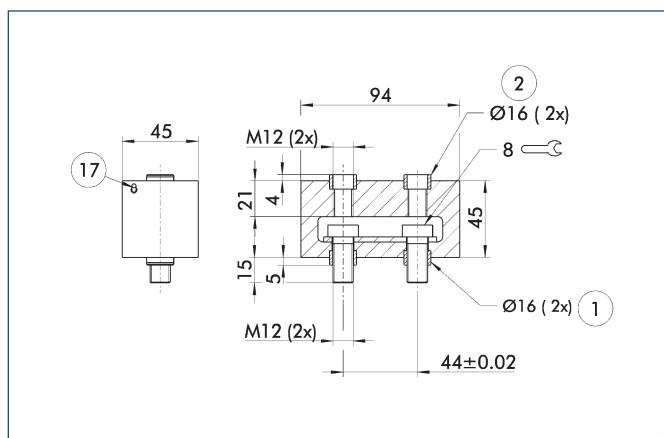
- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

## FMS-ZBP 200



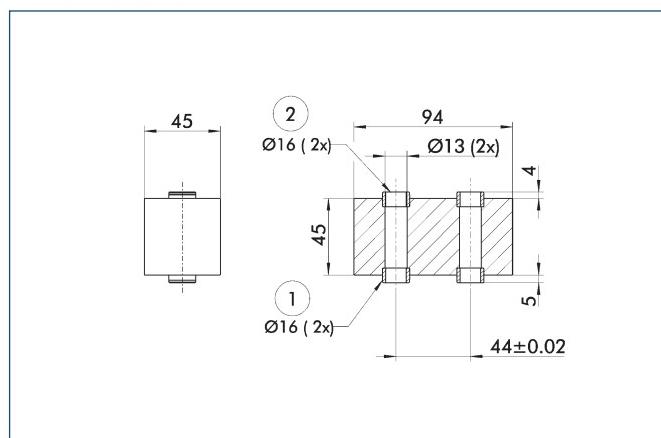
- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

## FMS-ZBA 240

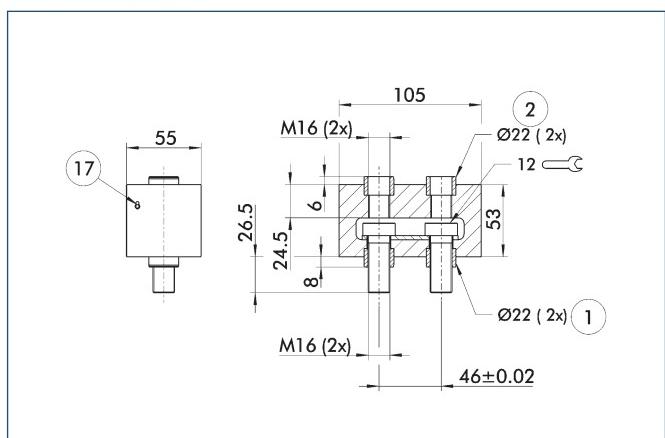


- (1) Gripper connection
- (2) Finger connection
- (17) Cable outlet

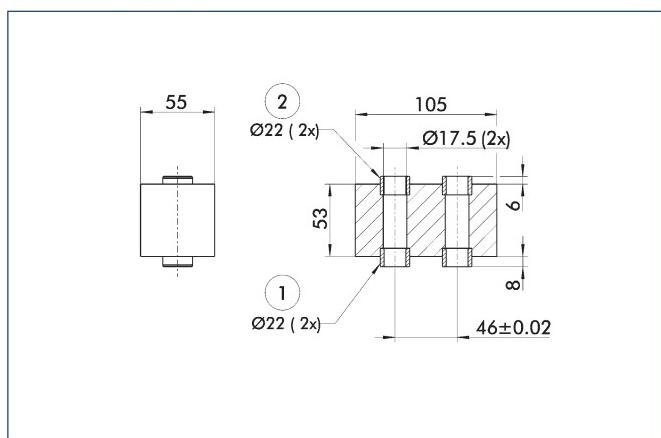
## FMS-ZBP 240



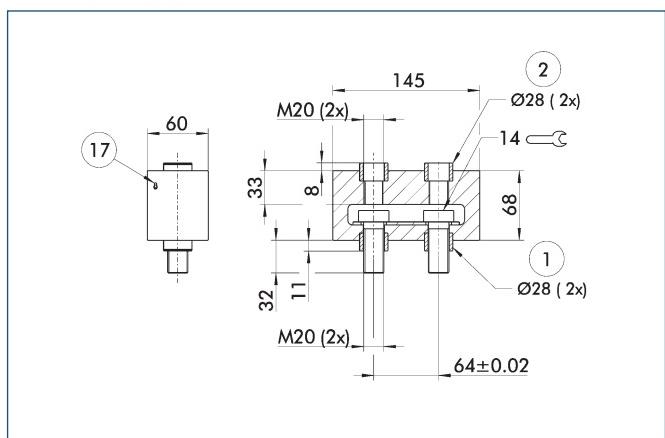
- (1) Gripper connection
- (2) Finger connection

**FMS-ZBA 300**

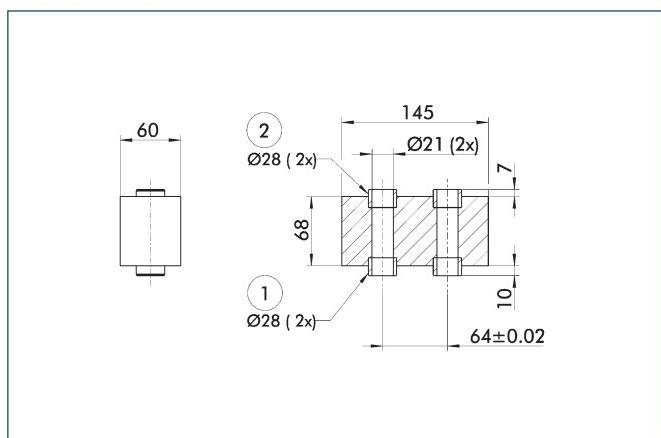
- ① Gripper connection
- ② Finger connection
- ⑯ Cable outlet

**FMS-ZBP 300**

- ① Gripper connection
- ② Finger connection

**FMS-ZBA 380**

- ① Gripper connection
- ② Finger connection
- ⑯ Cable outlet

**FMS-ZBP 380**

- ① Gripper connection
- ② Finger connection

